3.8 WILDLIFE

3.8.1 Introduction

The goal of the wildlife section is to describe the biology of and analyze the impacts of the three proposed alternatives on six selected amphibian species that are considered sensitive to forest practices, as well as other riparian-dependent species that may be significantly affected by the proposed changes to the Washington FPR. The six amphibian species are the Van Dyke's salamander (*Plethodon vandykei*), the Dunn's salamander (*Plethodon dunni*), the Columbia torrent salamander *(Rhyacotriton kezeri*), the Cascade torrent salamander (*Rhyacotriton cascadae*), the Olympic torrent salamander (*Rhyacotriton olympicus*), and the tailed frog (*Ascaphus truei*). They were selected because: 1) they are closely associated with aquatic and riparian habitats; 2) they have been shown to be sensitive to timber harvest; and 3) they lack significant federal protection in some portion of their range (either through status or occurrence on federal lands). Some other aquatic or riparian-associated species with special status are generally addressed. These species include the red-legged frog, Oregon spotted frog, western pond turtle, harlequin duck, great blue heron, beaver, muskrat, mink, and otter. Although most of Washington's terrestrial vertebrate species use riparian habitats for essential life activities (Knutson and Naef, 1997), analysis of the alternatives emphasizes those species with special status most likely to be affected.

Quantitative analyses presented in the environmental effects section based primarily on analyses presented in Sections 3.5 (Riparian Habitat) and 3.6 (Wetlands), as well as on Appendices C (Riparian Habitat) and F (Wetlands). These analyses will be used to compare the two proposed alternatives with the current FPRs using three different evaluation criteria: (1) how well the alternatives would protect the quality and quantity of riparian habitat as measured by a variety of forest microhabitat variables important to the target species (e.g., microclimate, downed wood, and sedimentation); (2) how well the alternatives would protect unique habitats known to be priority habitat for amphibians (e.g., stream junctions); and (3) how well the alternatives would protect habitat of other riparian-dependent species (i.e., beaver).

3.8.2 Affected Environment

3.8.2.1 Importance of Riparian Habitats to Wildlife

Riparian areas are among the most important wildlife habitats in Washington. Approximately 85 percent of Washington's terrestrial vertebrate species use riparian habitat for essential life activities (Knutson and Naef, 1997; Thomas et al., 1979; Brown et al., 1985). O'Connell et al. (1993) and Oakley et al. (1985) provide extensive reviews of the literature on wildlife use of riparian areas. This section highlights some significant contributions of several attributes of riparian habitat that are of particular importance to amphibians and other riparian-dependent species. These include complex vegetation structure, snags and downed woody debris, edge effect, and connectivity.

Complex Vegetation Structure

Riparian zones are noted for their structural complexity. They often are characterized by a variety of vegetation layers, including herbaceous, shrub, sapling, tree, and overstory layers (Oakley et al., 1985). This floristic diversity is encouraged by the frequent disturbance in most riparian areas, particularly along larger streams, due to flood events, mass wasting events, fire, windthrow, etc (Wissmar et al., 1994; Agee, 1994). A high degree of vegetative structures in a riparian zone provides abundant sites for breeding, roosting, foraging, and hiding for numerous species. In particular, riparian vegetation structure has been shown to be very important to breeding songbirds (Sanders and Edge, 1998; Knopf, 1985; Martin, 1988; Hagar, 1999). Doyle (1990) and McComb et al. (1993) reported that structural diversity of riparian vegetation was important to small mammals. However, narrow riparian zones along small streams often do not provide structural diversity enhancement beyond that provided by adjacent upland areas.

Snags and Downed Woody Debris

Snags and downed woody debris serve very important biological functions for a wide variety of species. Many birds and small mammals use cavities in snags for nesting and resting. Brown (1985) estimates that over 100 species of wildlife use snags, with approximately 53 of them being cavity-dependent. These species include woodpeckers, cavity-nesting ducks, owls, bats, and most mustelids. Marten and fisher use cavities in live and dead trees as nest sites (Ruggiero et al., 1994). Snags and downed woody debris provide other important habitat functions, including foraging, roosting, and perching. Wildlife will use a wide variety of trees in different stages of decay, including trees with heart rot, hollow trees, broomed trees, completely dead snags, and downed logs of all decay classes (Bull et al., 1997). For instance, Bull et al. (1992) found that pileated woodpeckers in the Blue Mountains of Oregon selectively roosted in live and dead grand firs that were extensively decayed by Indian paint fungus. In the same region, downed logs provide important habitat for forest-dwelling ants, which are a primary prey of pileated woodpeckers (Torgersen and Bull, 1995). Similarly, density of cavity-nesting birds in other regions has been positively correlated with the density of large snags (Raphael, 1980; Madsen, 1985). Marten use large downed logs for predator avoidance, thermal protection, and natal dens (Buskirk and Ruggiero, 1994).

Timber harvesting has been shown to reduce the density of snags in the landscape and this has been correlated with reduced abundance of cavity-nesting species (Dickson et al., 1983; Brown et al., 1985; O'Connell et al., 1993). Retention of riparian buffer strips has the potential to maintain greater densities of snags and downed logs in the landscape. Environmental conditions in riparian and wetland areas can contribute to the production of snags and downed logs. Undercut slopes, soil saturation, ponding, high water, and other types of soil disturbance that are common in riparian areas can all contribute to the weakening of trees and subsequent production of snags or deformities. Furthermore, riparian buffer strips that border clearcuts are very vulnerable to windthrow. One study of 40 buffers on small streams in northwest Washington found that an average of 33 percent of all trees in the buffers were affected by windthrow (Grizzel and Wolff, 1998). This windthrow increased the large in-stream woody debris counts in this study by 52 percent compared to counts at the time of harvest (1 to 3 years earlier). This study concluded that windthrow may be the most important mechanism for LWD recruitment to stream channels. However, these authors caution that much of this LWD is suspended over narrow, confined channels and does not contribute to sediment retention (Grizzel and Wolff, 1998). Partially submerged snags in wetlands, particularly beaver ponds, are important habitat for species such as cavity-nesting ducks, tree swallows, woodpeckers, and osprey (Knutson and Naef, 1997).

Windthrow is not the only mechanism that can reduce the amount of snags in a riparian zone. Some snags in a given riparian zone will have to be removed prior to and during adjacent timber harvest activities to meet state safety regulations. According to chapter 296-54 of the WAC, any tree that presents a hazard to workers because of some observable natural or manmade defect is labeled a "danger tree" and must be removed. Although no data is available to quantify the effect of this regulation on the amount of snags in riparian areas, Alternative 2 does include several restrictions and requirements that would protect snags and other wildlife trees. These include: (1) any trees in the core or inner zone in Western Washington damaged by yarding must be left; (2) at least 5 wildlife trees per acre must left in RMZs on westside 20-acre exempt parcels; (3) all wildlife trees must remain in RMZs on eastside 20-acre exempt parcels; and (4) the minimum trees per acre requirements for westside RMZs would be expected to be high enough that a component of dead snags is insured.

Edge Effect

The edge effect is a term used to describe the potentially positive and negative effects associated with the ecotone between two different habitat types. These effects can include increased exposure to predation, increased prey availability, increased vegetative structural complexity, and increased exposure to light and heat. It is generally used in reference to the ecotone between recently harvested areas and older forests, but it can also be applied to the ecotone between riparian areas and upland habitats. Riparian areas, due to their usually long and sinuous shape, are dominated by edge habitat. Edge habitat is characterized by the presence of species representative of both the riparian zone and the adjacent habitat. The diverse vegetation and complex structure that characterizes the edge of riparian zones makes this area attractive and beneficial to many species, particularly generalist species (Knutson and Naef, 1997; Wilcove et al., 1986). These species benefit from the myriad of different nesting and perching substrates as well as multiple vegetation layers (e.g., grass, herb, shrub, tree) and usually more abundant food sources such as berries or insects (Knutson and Naef, 1997). Species richness is thus often greater in edge habitat (Fraver, 1994). On the other hand, some studies have demonstrated the negative effects of edge habitat on species that are adapted to the conditions of forest away from the edge (i.e., interior habitat). Increased edge habitat can increase exposure to predators such as crows and ravens, brown-headed cowbirds, and raccoons. A literature review by Paton (1994) suggested that predation and parasitism rates are often significantly greater within 164 feet of an edge. Nelson and Hamer (1995) found that successful marbled murrelet nests were located significantly farther from edges (> 180 feet) than unsuccessful nests. The effects of predation have been shown to extend up to 2,000 feet into a stand (Wilcove et al., 1986).

Numerous studies have demonstrated or suggested widths for riparian buffers to maintain the diversity of interior forest species. Several studies have shown that riparian buffer strips up to 230 feet wide maintain some, but not all, of the species diversity of the interior forest bird guild (Hagar, 1999; Kinley and Newhouse, 1997). Even wider zones (>1,500 feet) were suggested by Kilgo et al. (1997) to maintain all the species associated with undisturbed bottomland hardwood forests in South Carolina. Most riparian buffers would be too narrow to support populations of many species, particularly larger mammals such as marten or fisher (Ruggiero et al., 1994). However, for some species that are more dependent on the aquatic and riparian habitats, such as beaver, mink, and river otter, riparian buffer strips may be able to maintain enough habitat to support all their habitat requirements. Beavers do most of their foraging and dam construction within 700 feet of the water's edge (Allen, 1983). Similarly, river otter and mink spend most of their time in close proximity to moving water (O'Connell et al., 1993). Other species, such as black bear, often occur in riparian areas due to abundance of food and prey items, but are not limited to those areas for reproduction (O'Connell et al., 1993).

Connectivity

Riparian areas can provide important habitat linkages in the landscape. Many different species have been documented using riparian areas for travel and dispersal (Lovejoy et al., 1986; Brown et al., 1985; Gibbs, 1998; Harris, 1984). Although very few species are limited to riparian corridors for movement, many mobile species such as marten, fisher, cougar, deer, and birds will utilize riparian corridors. Beier (1993) documented cougars in the Santa Ana Mountains of southern California using relatively narrow riparian corridors for movement. Machtans et al. (1996) found that forest birds would utilize habitat corridors more often than clearcuts. The potential value of riparian corridors increases in a fragmented landscape as they become the only safe way for some species to cross unsuitable habitat, which is the case for the cougars in the Beier (1993) study.

3.8.2.2 Target Amphibian Species

In this section the six target amphibian species are discussed. The discussions include a general description of each species and its status in Washington, the distribution of the species by region, a description of the habitat preferences and relationships with forest management.

Van Dyke's Salamander

The Van Dyke's salamander is a plethodontid salamander endemic to Washington. Van Dyke's salamanders are known from three areas of Washington: the Olympic Mountains, the southern Cascades (including populations in southeastern Thurston County), and the Willapa Hills (Leonard et al., 1993). Populations of this species are generally small and fragmented compared to other Pacific Northwest woodland salamanders (Nordstrom and Milner, 1997; Wilson et al., 1995; Brodie, 1970). Most of the recorded locations for this species come from the wetter, western slopes of these areas (Dvornich et al., 1997). The Van Dyke's salamander is a Washington State Candidate species for listing, is considered an "at-risk" species by the Washington State GAP Analysis Project (Cassidy et al., 1997), and is a Survey and Manage species under the Northwest Forest Plan (USDA and USDI, 1994). Two out of three regions where this species occurs are dominated by federal ownership (Olympic National Park and Wilderness Area, Mount Saint Helens National Monument, Gifford Pinchot National Forest), and the third is dominated by private commercial forest lands (southwest Washington).

This species has been said to be more strongly associated with aquatic and riparian environments than most other plethodontids, with the possible exception of the Dunn's salamander (Leonard et al., 1993). However, relatively few studies have been done to characterize the habitat limitations of the Van Dyke's salamander (Jones, 1989; Wilson et al., 1995). Van Dyke's salamanders have been found inhabiting seeps, streams, and north-facing slopes with rocky substrates in forested areas from sea level to 3,600 feet (Leonard et al., 1993; Nordstrom and Milner, 1997). They have also been found associated with large downed woody debris in riparian and upland areas removed from any rocky substrates (Wilson et al., 1995). These sites were usually in areas of high precipitation along the Washington Coast (Wilson et al., 1995). Wilson et al. (1995) found that the distribution of this species in Washington was limited by precipitation, unconsolidated geologic deposits, and temperature. Areas where Van Dyke's salamander populations have been found, in almost every case, have precipitation greater than 59 inches annually, do not have unconsolidated sediments, and have a soil temperature above 43 degrees F (Wilson et al., 1995).

Some studies have suggested that the distribution of Van Dyke's salamander has been limited by clearcutting (Wilson et al., 1995; Corn and Bury, 1989). Wilson et al. (1995) suggests that rapid logging of the lowland forest separating the three concentrations of the Van Dyke's salamander may have contributed to their isolation. It is logical that where this species is more dependent on downed woody debris it would be more susceptible to negative impacts from logging. Furthermore, logging can compact rocky substrates where this species may be seeking shelter. Another reason this species is particularly sensitive to timber management is because it is often found associated with headwaters and nonfish-bearing streams, which currently receive relatively little protection (i.e., riparian buffers) from harvest. At least one study has shown that riparian buffers can encourage persistence of amphibians following timber harvest (West and O'Connell, 1998). However, exactly how disturbance types, timber harvest prescriptions, or potential RMZ prescriptions may affect persistence of Van Dyke's salamanders in the landscape is unknown.

Dunn's Salamander

The Dunn's salamander is one of our largest plethodontid salamanders. It can reach 6 inches in total length (Leonard et al., 1993; Nussbaum et al., 1983). Dunn's salamanders are known to occur from northwestern California to extreme southwestern Washington (Nussbaum et al., 1983; Leonard et al., 1993). In Washington, they only occur in the Willapa Hills, which is the northernmost limit of their range (Leonard et al., 1993). Most of the record locations for this species come from Pacific, Lewis, Wahkiakum, and Cowlitz counties (Dvornich et al., 1997). The Dunn's salamander is a Washington State Candidate species, is considered an "at-risk" species by the Washington State GAP Analysis Project (Cassidy et al., 1997). Most of the range of this species in southwest Washington is dominated by private commercial timberlands.

Dunn's salamanders have been found inhabiting wet, rocky substrates that are heavily shaded, including seeps, streams, wet talus slopes, and stream edges in forested areas from sea level to 3,300 feet (Leonard et al., 1993; Nordstrom and Milner, 1997). Corn and Bury (1991) found a significant association between the abundance of Dunn's salamanders in the Oregon Coast Range and the percent cover of rock. They also found that Dunn's salamanders occurred more often on steep slopes, where exposed talus was present, and in stands at higher latitudes (Corn and Bury, 1991). Dunn's salamanders are not considered aquatic, but rather riparian associates (Corkran and Thoms, 1996; Gomez and Anthony, 1996). Results of Bury et al. (1991) support this conclusion. Approximately 90 percent of Dunn's salamanders observed in their study were found in stream bank habitat as opposed to riffle or pool habitat.

Timber management has been identified as a human activity that can disturb habitat for Dunn's salamanders (Nordstrom and Milner, 1997). Timber harvest can remove canopy cover that maintains microclimatic conditions favored by this species, including cool substrate temperatures and high relative humidity (Nordstrom and Milner, 1997; Ledwith, 1996; Chen et al., 1993, 1995). Timber harvest can also disturb the rocky substrate that is preferred habitat of Dunn's salamanders. Another reason this species is particularly sensitive to timber management is because it is often found associated with headwaters and nonfish-bearing streams, which currently receive relatively little protection (i.e., riparian buffers) from harvest. At least one study has shown that riparian buffers can encourage persistence of amphibians following timber harvest (West and O'Connell, 1998). Furthermore, several studies have demonstrated a direct relationship between buffer width and the maintenance of cool microclimate and high humidity (Ledwith, 1996; Brown and Krygier, 1970).

Olympic Torrent Salamander

The Olympic torrent salamander is the original species from which four species of torrent salamander were split by Good and Wake (1992). Three of these four torrent salamanders occur in Washington; the Olympic, Cascade, and Columbia torrent salamanders. All torrent salamanders are stream-adapted larval salamanders (larvae have gills and four legs) characterized by very short gills, depressed body, and a low short caudal fin (Nussbaum et al., 1983). Olympic torrent salamanders are known to occur only on the Olympic Peninsula of Washington (Nussbaum et al., 1983; Leonard et al., 1993). Most recorded locations for this species come from Clallam, Jefferson, and Mason counties (Dvornich et al., 1997). The Olympic torrent salamander is considered an "at-risk" species by the Washington State GAP Analysis Project (Cassidy et al., 1997). Most of the range of this species is dominated by federal land ownership (mainly Olympic National Park and Wilderness Area).

Habitat requirements for torrent salamanders are thought to be similar to the other three species. Therefore, this discussion makes reference to studies on all four species across their range. Generally, torrent salamanders are very closely associated with cold, clear streams, seeps, or waterfalls (Leonard et al., 1993). They are often found in the splash zone of rapidly flowing, steep gradient streams or in saturated moss or talus nearby (< 1m), hiding under cover objects (Blaustein et al., 1995; Bury et al., 1991). Several studies have observed a strong association between the abundance of torrent salamanders and the presence of old-growth forests (Corn and Bury, 1991; Corn and Bury, 1989; Welsh and Lind, 1991). These studies suggest that the cause of this association is that old-growth forest help maintain suitable cool water temperatures that torrent salamanders require for survival. Welsh and Lind (1996) reported that suitable water temperatures for torrent salamanders are usually between 6.0 and 15.0 degrees Celsius. This association with old-growth forests may be secondary to other factors such as slope, aspect, and geologic formation in some areas, particularly moist coastal environments such as northwestern California (Diller and Wallace, 1996; Welsh and Lind, 1996).

Timber harvest can remove canopy cover that maintains microhabitat conditions favored by this species, including cool substrate temperatures and high relative humidity (Nordstrom, 1997; Ledwith, 1996; Chen et al., 1993, 1995). Timber harvest and associated road construction activities have also been documented to increase the risk of debris torrents, causing scouring and increasing the presence of fine sediments in headwaters and high-gradient streams (Morrison, 1975; Swanston and Swanson, 1976). The presence of fine sediments has been shown to severely reduce instream habitat quality by filling interstitial spaces critical to salamanders for movement and larval development (Corn and Bury, 1989; Diller and Wallace, 1996). However, another study has suggested that deposition of the finest sediments, which are mainly composed of organic matter, are important to these salamanders for food (Welsh and Lind, 1996). Notably, most of the studies that demonstrate negative effects of sedimentation are from the ranges of the southern species, not the Olympic torrent salamander. Streams in the range of the southern torrent salamander (northwestern California and southwestern Oregon) are prone to carry heavier sediment loads than streams in the Olympics and Washington Cascades due to the presence of unconsolidated marine sediments, heavier rainfall, and warmer climate. Thus, the northern torrent salamanders may experience fewer sedimentation problems than the southern species.

Even more so than Van Dyke's or Dunn's salamander, the torrent salamander is associated with headwater streams, seeps, and springs (Nordstrom, 1997; Welsh and Lind, 1996; Diller and Wallace, 1996). This means that they receive even less benefit or protection from the current FPRs. However, most of the range of this species in Washington is in federal ownership.

Cascade Torrent Salamander

The Cascade torrent salamander is the most variable species of torrent salamander. Cascade torrent salamanders are distributed in the Cascade Mountains of Washington and Oregon from just north of Mount Saint Helens, Washington to northeastern Lane County, Oregon (Leonard et al., 1993). The valley of the Cowlitz River separates its range from that of the Olympic torrent salamander. Most recorded locations for this species in Washington come from Skamania, Cowlitz, and Clark counties (Dvornich et al., 1997). The Cascade torrent salamander is a state Candidate species in Washington and is considered an "at-risk" species by the Washington State GAP Analysis Project (Cassidy et al., 1997). Federal land ownership (Gifford Pinchot National Forest and Mount Saint Helens National Monument) dominates much of the range of this species.

Habitat requirements and effects of timber management on the Cascade torrent salamander are similar to those of the Olympic torrent salamander (see above).

Columbia Torrent Salamander

The Columbia torrent salamander is distributed in the Coast Ranges of Washington and Oregon from the Willapa Hills/Long Island area of Washington to the Grand Ronde River Valley in Oregon (Leonard et al., 1993). The valley of the Chehalis River separates its range from that of the Olympic torrent salamander. Most recorded locations for this species in Washington come from Pacific, Lewis and Wahkiakum counties (Dvornich et al., 1997). The Columbia torrent salamander is a state Candidate species in Washington and is considered an "at-risk" species by the Washington State GAP Analysis Project (Cassidy et al., 1997). Most of the range of this species in Washington is dominated by private commercial timberlands.

Habitat requirements and effects of timber management on the Columbia torrent salamander are similar to those of the Olympic torrent salamander (see above). In particular, a recent study by Grialou and others (2000) found that Columbia torrent salamanders were absent from clearcuts in southwestern Washington within several years after harvest.

Tailed Frog

The tailed frog is a widely distributed frog endemic to the Pacific Northwest. It is the only member of the genus *Ascaphus*, one of the two extant genera in the world's most primitive frog family (Welsh et al., 1993). Tailed frogs are found in the Olympic, Cascade, Blue, Wallowa, and Siskiyou mountains of Washington and Oregon, as well as the Oregon Coast Range and northwestern California (Leonard et al., 1993; Blaustein et al., 1995). They have been found from sea level to approximately 7,000 feet in elevation (Leonard et al., 1993). In Washington, tailed frogs have also been reported from the Willapa Hills and Capitol State Forest (Dvornich et al., 1997). The tailed frog is considered an "at-risk" species by the Washington State GAP Analysis Project (Cassidy et al., 1997) due to its strong association with cold, clear mountain streams. Due to its wide distribution, the range of the tailed frog includes a wide variety of land ownerships throughout the mountainous regions of the state.

The tailed frog is considered more strongly associated with cold, permanent, fast-flowing streams than any other anuran (Nussbaum et al., 1983; Welsh et al., 1993). Tailed frogs are highly adapted for life in fast-flowing headwater streams. These adaptations include internal fertilization of females, reduced lungs, hardened fingertips, and lack of vocalizations (Leonard et al., 1993; Welsh et al., 1993). Larvae are entirely aquatic, requiring between one year (in lowland areas) and four years (in high elevation areas) to reach metamorphosis (Leonard et al., 1993; Welsh et al., 1993). Tailed frogs have also been shown to be strongly associated with old-growth forests (Blaustein et al., 1995; Welsh et al., 1993; Corn and Bury, 1991; Aubry and Hall, 1991; Corn and Bury, 1989; Welsh and Lind, 1988). These older forests are usually more structurally complex, containing a multi-layered canopy and an abundance of downed woody debris. This structural complexity may contribute a stable streamside environment with the microhabitat characteristics that are required by tailed frogs. Tailed frogs have the narrowest range of temperature requirements of any frog native to Washington. Their eggs require water temperatures between 5 degrees and 18.5 degrees Celsius (Brown, 1975). Tailed frogs have also been shown to be sensitive to sedimentation, which may negatively impact important food sources such as nonfilamentous algae (Welsh and Ollivier, 1998). The tailed frogs narrow habitat requirements suggest that they are more vulnerable than other frogs to population declines following habitat disturbance. This conclusion is supported by studies in northwestern California (Welsh et al., 1993) and Washington (Aubry and Hall, 1991) and Oregon (Bull and Carter, 1996).

Timber harvest has the potential to diminish the quality of tailed frog habitat by increasing sedimentation in streams, removing canopy cover important for maintaining stream temperatures, removing downed woody debris, and compacting riparian substrates

(Leonard et al., 1993; Blaustein et al., 1995). Corn and Bury (1989) and Dupuis and Steventon (1999) found that logging had significant negative effects on densities of tailed frogs. The latter study also found that buffered creeks in their study area (in British Columbia), on average, had higher densities of tailed frogs than logged creeks. This study also suspected that increased sediment input from logging played a larger part in their results than did increased stream temperature. Several studies have also suggested that riparian buffer strips may be able to protect the streamside microhabitat variables required by tailed frogs even if the surrounding habitat is not maintained as old-growth (Bull and Carter, 1996; Corn and Bury, 1989).

3.8.2.3 Other Riparian-Dependent Species

This section presents a general description of the other wildlife species in Washington, including rare, threatened, and endangered species, that would be most affected by the alternatives. Table 3.8-1 lists all of these riparian-associated species that have some special status within the state. This list is not intended to be a complete list of all species native to Washington that use riparian areas; instead, it is a list of sensitive species or species with some sort of state or federal status that would potentially be significantly impacted by the proposed alternatives.

Seventy-nine percent of Washington amphibian species use streams, ponds, and temporary waters for mating, egg deposition, and larval development (Nussbaum et al., 1983). Because of their limited range, limited mobility, and sensitivity to water temperature and quality, amphibians are particularly sensitive to alterations of riparian and aquatic habitat (Nussbaum et al., 1983). Several of the amphibian species with special status in Washington, such as the Oregon spotted frog, have limited distributions and thus may be more at risk from disturbance than other species (Knutson and Naef, 1997).

One reptile species with special status, the western pond turtle, uses aquatic and riparian habitats for most of its life requisites (Hays et al., 1999). Large woody debris is particularly important for cover and basking sites for this species (Knutson and Naef, 1997).

Table 3.8-1. Washington Special Status and High Profile Species with Strong Riparian Associations

Common Name	Scientific Name	Status[1/]	Distribution[2/]	Use of Riparian Areas[3/]
Amphibians				
Columbia torrent salamander	Rhyacotriton kezeri	SC, FSC	5 6	Stream/Creek - b, f
Cascade torrent salamander	*Rhyacotriton cascadae*	SC	5 6	Stream/Creek - b, f
Dunn's salamander	*Plethodon dunni*	SC	5 6	Stream/Creek - b, f
Van Dyke's salamander	*Plethodon vandykei*	SC, FSC	5 6	Stream/Creek - b, f
Red-legged frog	*Rana aurora*	FSC	4 5 6	Lake/Pond/Slough - b, f
Cascades frog	*Rana cascadae*	FSC	2 3 4 5 6	Lake/Pond/Stream - b, f
Northern leopard frog	*Rana pipiens*	SC	1 2 3 5	Lake/Pond - b, f
Oregon spotted frog	*Rana pretiosa*	SE, FC	5 6	Lake/Pond - b, f
Columbia spotted frog	*Rana luteiventris*	SC, FSC	1 2 3 4	Lake/Pond - b, f
Western toad	*Bufo boreas*	SC	1 2 3 4 5 6	Lake/Pond - b, f
Olympic torrent salamander	Rhyacotriton olympicus		6	Stream/Creek – b, f
Tailed frog	Ascaphus truei		1 2 3 4 5 6	Stream/Creek – b, f
Reptiles				
Western pond turtle	*Clemmys marmorata*	SE, FSC	4 5 6	Lake/Slough/Stream - f
Sharptail snake	*Contia tenuis*	SC	2 3 5 6	Wetlands - b, f
Birds				
Common loon	Gavia immer	SC	1 2 3 4 5 6	Lake - b, f
Aleutian Canada goose	*Branta canadensis leucopareia*	ST, FT	5 6	Lake - b, f
Harlequin duck	*Histrionicus histrionicus*	FSC	1 2 3 4 5 6	River/Stream - b, f
Bald eagle	*Haliaeetus leucocephalus*	ST, FT	1 2 3 4 5 6	River/Lake - f
Sandhill crane	*Grus canadensis*	SE	1 2 3 4 5 6	Wetlands - b, f
Yellow-billed cuckoo	*Coccyzus americanus*	SC	1 2 4	Stream/Slough - b, f
Willow flycatcher	*Empidonax traillii*	FSC	1 2 3 4 5 6	Stream/Pond - b, f
Pileated woodpecker	*Dryocopus pileatus*	SC	1 2 3 4 5 6	River/Stream – b, f
Great blue heron	*Ardea herodias*	P	1 2 3 4 5 6	Stream/Wetlands – b, f
Wood duck	*Aix sponsa*	P	1 2 3 4 5 6	River/Stream – b, f
Mammals				
Shaw Island Townsend's vole	*Microtus townsendii pugeti*	FC	4	Stream/Lake/Pond - b, f
Columbian white-tailed deer	*Odocoileus virginianus leucurus*	SE, FE	5	Stream/Slough – b, f
Mink	*Mustela vison*	P	1 2 3 4 5 6	River/Stream – b, f
Beaver	*Castor canadensis*	HP	1 2 3 4 5 6	Stream/Creek – b, f
Muskrat	*Ondatra zibethicus*	HP	1 2 3 4 5 6	Stream/Wetlands – b, f
River Otter	*Lutra canadensis*	HP	1 2 3 4 5 6	River/Stream – b, f

[1/] SE = State Endangered; ST = State Threatened; SC = State Candidate; FE = Federal Endangered; FT = Federal Threatened; FC = Federal Candidate; FSC = Federal Species of Concern; P = Priority species with WDFW, but not listed; HP = high profile/high public interest.

[2/] Numbers indicate WDFW Regions: 1 = Eastern; 2 = North Central; 3 = South Central; 4 = North Puget Sound; 5 = Southwest; 6 = South Puget Sound and Coastal.

[3/] Indicates type of riparian area used, and type of use (b = breeding; f = foraging), based on Brown, 1985.

Several groups of birds are closely associated with riparian areas. These include many neotropical migrants, cavity-nesting birds (i.e., woodpeckers and waterfowl), waterfowl, and raptors (mainly the bald eagle and osprey). The complexity of riparian vegetation, as described earlier (see Section 2.1.1), provide breeding, foraging, and cover habitat for many of these species (Knutson and Naef, 1997).

A wide variety of mammals are closely associated with riparian areas. At least five endemic small mammals are considered obligate inhabitants of streamside areas: water shrew, marsh shrew, muskrat, beaver, and water vole (O'Connell et al., 1993). The habitat characteristics of riparian areas, including presence of water, abundance of food, moist microclimate, and edge habitat support the life requisites of these species and a wide variety of other mammal species, including river otter, mink, raccoon, black bear, fisher marten, mule deer, and elk (Knutson and Naef, 1997). Timber harvest has the potential to reduce (and in some cases increase) the populations of these species by affecting cover, decreasing or increasing the prey base or food sources, and affecting breeding areas.

3.8.3 Environmental Effects

3.8.3.1 Evaluation Criteria

This section describes the three evaluation criteria that were chosen to evaluate how the proposed alternatives would impact wildlife resource. They are: (1) the degree of protection afforded to various microhabitat variables, such as humidity and air temperature, sedimentation, and downed wood, that are important to the six target species by each alternative, (2) the degree of protection afforded to various unique habitat types that are important to the target amphibian species, and (3) the degree of protection afforded to various habitat types important to the other riparian-associated wildlife species identified in Table 3.8-1. These evaluation criteria are described in more detail below.

Microhabitat Variables Important to the Target Amphibian Species

There are several components of the microenvironment of riparian areas that influence the suitability of that habitat for amphibians. They include microclimate, downed wood, and sedimentation.

Some of the important microclimatic parameters of riparian areas include solar radiation, soil temperature, soil moisture, air temperature, wind velocity, and air moisture or humidity. These microclimatic parameters are generally different in riparian than upland areas. Riparian areas are usually lower in the landscape, are closer to water, and tend to have more complex vegetation structure. These characteristics contribute to a cooler, moister microenvironment for amphibians. Timber harvest activities can disrupt this microclimatic gradient between upland and riparian areas (see Section 3.5 - Riparian Functions, Microclimate for more information). For instance, timber harvest can expose a riparian area to increased solar radiation, thus potentially increasing the ambient air and water temperatures in that area and reducing the relative humidity and soil moisture. Brosofske et al. (1997) found that no-harvest riparian buffers between 148 feet and 984 feet in width were needed to maintain unaltered microclimatic gradients near streams.

Based on this study, many standard buffer widths currently in use may not fully protect riparian microclimate.

Timber management activities can change the quantity and size of sediment that is delivered to a stream. This can lead to stream channel instability, pool filling by coarse sediment, or introduction of fine sediment to spawning gravels. Increased sedimentation in headwater streams has been shown to negatively impact some amphibian species by filling interstitial spaces in the stream substrate that are important for movement and larval development (Corn and Bury, 1989; Diller and Wallace, 1996). Riparian buffer strips in Washington have been shown to be effective in filtering overland sediment, with strips of no-harvest buffers of at least 30 feet identified as effective in some cases (Rashin et al., 1999).

Downed wood is an important microhabitat feature for amphibians. Bury et al. (1991a) found that terrestrial salamander abundance was associated with the presence of coarse woody debris. Ensatina and western redback salamander abundance was positively correlated with amounts of coarse woody debris in western Washington forest (Aubry et al., 1988; Aubry and Hall, 1991). Coarse woody debris provides moist sites where amphibians can seek shelter from predators, forage on the soil surface while still maintaining body moisture, and breed. Nordstrom and Milner (1997) recommend that a minimum of 5 uncharred hard logs at least 12 inches in diameter and 23 feet long per acre, as well as all soft logs the same size, should be retained to provide suitable coarse woody debris for Dunn's and Van Dyke's salamanders. Large woody debris in streams also provides cover for amphibians, as well as erosion control and substrate for egg deposition (see Section 3.5 - Riparian Functions, LWD Recruitment, for more discussion of LWD).

All of these components are evaluated according to how adequately the proposed alternatives provide riparian buffers and other suitable regulations to maintain them. For management of amphibians, WDFW recommends buffer widths between 35 and 100 feet to retain appropriate shade on streams, widths between 100 and 180 feet to maintain woody debris recruitment, and widths up to 300 feet to control sedimentation (Larsen, 1997). As described in Section 3.5.3.1 (Riparian Function Criteria), the results of Brosofske et al. (1997), Dong et al. (1998), and Chen (1991) indicate that a minimum of 147 feet is considered necessary to maintain most microclimatic gradients, buffer widths greater than 230 feet for air temperature are required, and buffers of up to 787 feet are required for protection of humidity. Ledwith (1996) demonstrated that buffer widths of at least 100 feet between clearcuts and streams in northern California significantly reduce air temperature and increase relative humidity. Other studies have reported that 100-foot wide buffers between clearcuts and streams are sufficient to retain adequate shade on streams to maintain suitable stream temperatures for amphibians (Brown and Krygier, 1970; Brazier and Brown, 1973; Steinblums et al., 1984). Retaining buffer strips of at least 100 feet can help maintain woody debris recruitment (Bottom et al., 1983; Harmon et al., 1986; VanSickle and Gregory, 1990).

FEMAT (1993) recommends a buffer width of 170 feet in western Washington (which is equal to one site potential tree height) to provide complete protection for sediment filtration. This width was chosen because: (1) it meets the requirements of buffer widths recommended in the literature (Johnson and Ryba, 1992); and (2) it is consistent with the width chosen for the EBAI model (see Appendix D – Riparian Habitat). This is the distance that was assumed to be the baseline target for this analysis of that aspect of amphibian microhabitat requirements. Target widths for other microclimatic parameters are chosen from Brosotske and others (1993) and Chen (1991) (see above). Target guidelines for downed wood are difficult to determine. Amphibian species such as western red-backed salamander and ensatina are more closely associated with downed woody debris than are the target amphibian species. Nonetheless, at least one study recommends course woody debris retention in the range of 100-300 cubic meters per hectare to provide adequate cover for terrestrial salamanders (Butts and McComb, 2000).

Unique Habitats Important to the Target Amphibian Species

Many unique habitats in the landscape provide refugia for the target amphibian species. These include stream junctions, talus, downed woody debris, seeps, and springs. These unique habitats were chosen as evaluation criteria because (1) some of them are addressed separately in the proposed alternatives and (2) some of the target amphibian species are more closely associated with unique habitats than the background riparian zone. These components are evaluated according to how much and how well they are protected under the proposed alternatives. In addition to the unique habitats listed above, protection of wetlands was also chosen as an evaluation criterion for the effects of the alternatives. Although none of the six target amphibian species is directly associated with wetland habitats, wetland buffers and other protection measures can provide indirect protection for nearby unique habitats that may support populations of these species.

Other Riparian-Associated Species

The third criterion that was chosen for evaluating the potential impacts of the proposed alternatives on wildlife was the potential effects on other riparian-associated species in Washington. This criterion was limited primarily to species with special status (see Table 3.8-1). This criterion was chosen because so many species, other than the target amphibian species, use riparian areas for some portion of their life cycle. This criterion is evaluated qualitatively with regard to how well the protections proposed in Alternative 2 and 3 compare to existing FPRs.

3.8.3.2 Analysis of Alternatives

Microhabitat Variables and Target Amphibians

The first evaluation criterion was the potential protection afforded to microhabitat variables, including microclimatic variables, sedimentation, and downed wood, by the proposed alternatives.

ALTERNATIVE 1

Under Alternative 1 the current FPRs would be maintained. Current FPRs protect microhabitat variables only indirectly through various riparian prescriptions. The primary prescription that is currently directly applicable to the maintenance of suitable microhabitat conditions for amphibians is the stream-shade requirement, which provides enough shade on Type 1, 2 or 3 streams to maintain stream temperatures at either 16 and 18 degrees Celsius, depending on the classification of the stream and the elevation of the site (Forest Practices Board Manual M-5). In general, riparian buffers on Type 1 and 2 streams are between 25 and 100 feet wide, buffers on Type 3 streams are between 25 and 50 feet wide, while Type 4 and 5 streams generally have no protected buffer requirements (see Section 3.5).

Alternative 1 would result in high risk for most amphibian habitat variables along Type 1-3 streams and very high risk along Type 4 and 5 streams.

Based on recommended riparian widths, the RMZs provided for Alternative 1 for Type 1-3 waters, which range between 25 and 100 feet, do not maintain complete microclimatic conditions, downed woody debris recruitment, and sediment filtration. RMZs are not currently required on Type 4 and 5 streams, except under special circumstances; therefore maintenance of the microhabitat variables important to amphibians will not occur on these headwater streams. These conclusions are supported by the results of the EBAI analysis (see Section 3.4 and Appendix D), which concludes that Alternative 1 produces an EBAI for LWD of less than 30 percent of the recommended EBAI for complete protection of LWD recruitment potential for both fish-bearing and nonfish-bearing streams in both eastern and western Washington. Because the buffer requirements for LWD recruitment are more stringent than buffer requirements for protection of other riparian functions (i.e. - downed wood), the EBAI can also be used to compare relative protection for those parameters as well (see Appendix D). The EBAI for sediment filtration under Alternative 1 is 62 percent of the recommended EBAI for complete protection. This result is explained primarily by the lack of riparian protection, and thus sediment filtration, along Type 4 and 5 streams. Rashin et al. (1999) demonstrated that BMPs were ineffective without RMZs on Type 4 and 5 streams. Sullivan et al. (1990) demonstrated that current FPRs result in significant increases in air temperature in riparian areas.

There are some practices in the current FPRs that can mitigate for some of the lack of maintenance of these parameters and limit the effects of timber harvest on microhabitat, particularly some that apply to sediment delivery. These include: (1) clearcuts can be a maximum of 240 acres; (2) yarding in RMZs must minimize damage to vegetation; (3) sidecast along skid trails is limited to above the 50-year floodplain; (4) no more than 30 percent volume removal every 10 years within 200 feet of a designated shoreline (usually Type 1 waters); (5) riparian leave tree requirements are greater when stream substrate is gravel or cobble; and (6) hardwood to conifer ratios must be maintained.

ALTERNATIVE 2

Alternative 2 would be expected to improve the microclimate along streams by requiring a variety of more restrictive buffers compared to Alternative 1. These include a minimum no-harvest zone of 50 feet (i.e., the core zone), and selective harvest zones (with two options) up to a total of 200 feet beyond the bankfull width or CMZ of all Type S and F streams on the westside (depending on site class), and a minimum no-harvest zone of 30 feet and selective harvest zones up to a total of 130 feet beyond the bankfull width or CMZ of all Type S and F streams on the eastside. Furthermore, and perhaps more importantly for amphibians, Alternative 2 provides a variety of protective measures for Type N streams, which are primarily the streams that are Type 4 and 5 streams under Alternative 1.

These additional prescriptions include: (1) a 30-foot equipment limitation zone on all perennial and intermittent Type N streams; (2) a 50-foot no-harvest buffer applied on either side of all perennial Type N streams for the length of the stream up to 500 feet upstream of its intersection with a Type S or F stream; and (3) a 56-foot radius buffer patch surrounding the intersection of two or more perennial Type N streams. In addition to these prescriptions, a variety of protective buffers must be used by landowners to protect sensitive sites. These include: (1) no harvest within 50 feet of a soil zone perennially saturated from a headwall or side-slope seep and (2) no harvest within 50 feet of side-slope spring. Overall, at least 50 percent of the total length of Type N_p waters would receive 50-foot buffers.

> Alternative 2 would result in moderate risk of effects on amphibian microhabitat variables, especially along Type S and F streams in areas with high site classes, although proposed buffer widths would still be below optimum. Microhabitat variables would be well below optimum along nonfish-bearing streams with buffers and all habitat variables would lack protection along nonfish-bearing streams without buffers.

As described in Section 3.4 (Riparian Habitat), both options of Alternative 2 would provide improved LWD recruitment, particularly for fish-bearing streams. Under Alternative 2, the EBAI for sediment filtration (see Figure 3.2-2) is approximately 80 percent of the maximum protection for sediment filtration (see Section 3.2.3.2). Notably, the proposed arrangement of expanded linear buffers combined with nodes to protect sensitive areas of headwater streams under Alternative 2 is similar to the standardized buffer approach recommended by the WDFW to protect riparian features and functions important to torrent salamanders, Dunn's salamander, and Van Dyke's salamander (Larsen, 1997).

In contrast to Alternative 1, total buffer widths for site classes I and II approach or exceed the minimum buffer widths recommended for microclimatic parameters, at least on Type S and F streams. However, the no-harvest zones are not wide enough to allow microclimatic conditions to reach unharvested levels in the inner and outer zones. Protection of microclimate parameters along Type N streams would likely make it easier to maintain suitable amphibian habitat in Type S and F streams. Corn and Bury (1989) found that uncut timber upstream from logged stands promoted amphibian diversity in those areas. However, full maintenance of suitable microclimatic conditions along Type N streams may not be achieved, since these streams would be protected with a 50-foot no-cut buffer at most, which is much smaller than the 147-foot buffer recommended by the literature for complete protection.

Microclimatic conditions would be maintained through 100-foot wide no-harvest buffers that are proposed for Type S and F streams greater than 10 feet wide under Option 2. Option 2 under Alternative 2 leaves substantially more trees per acre in the inner and outer zones than Option 1. Although the proposed buffers would likely protect in-stream microclimatic conditions on site class I and II, Type S and F streams (which would benefit the highly aquatic torrent salamanders), microclimatic conditions in the terrestrial environment would approach upland levels as the outer edge of the buffers are approached. This means that the buffer itself would not maintain ideal conditions. Semlitsch (1997) recommends a buffer zone of over 500 feet in width as more ecologically realistic to protect important terrestrial habitat. Similarly, Dodd and Cade (1997) argue that regulatory buffers should consider the many types of amphibian migratory patterns in upland habitats in order to preserve habitat critical to all stages of the amphibians' life cycle.

Alternative 2 recommends the following downed wood guidelines associated with salvage logging in RMZs in western Washington:

Logs with a Solid Core	< 1 Foot Diameter	1-2 Foot Diameter	> 2 Foot Diameter	Total
Number of logs/acre	85	83	26	194

These guidelines may be translated to a downed wood retention range of between approximately 122 and 407 cubic meters per hectare assuming the following: (1) median diameters for each category above are .5, 1.5, and 2.5 feet; (2) logs are either 6 feet or 20 feet long. These amounts cover the entire range recommended in the literature. Therefore, the minimum amount of downed wood required to be left outside the core zone of RMZs in western Washington is adequate for amphibians. This parameter would be expected to have relatively minor effects on the highly aquatic torrent salamanders, and more significant effects on the other more terrestrial salamanders and frogs.

Overall, compared to Alternative 1, the changes to FPRs proposed under Alternative 2 would be expected to maintain suitable microclimatic, downed wood, and sediment delivery conditions for highly aquatic amphibians along site class I and II, Type S and F streams. This alternative would also significantly improve these same microhabitat conditions along other Type S and F streams, as well as along Type N streams. This improvement is due in part to the water typing changes proposed in Alternative 2. These changes include changing many streams that are currently classified as Type 4 streams to Type F streams, based on their gradient (see Appendix C). Microhabitat conditions in these higher site class streams and in the terrestrial habitat of the buffers would not be maintained at optimum levels for the target amphibian species. This would require wider buffers on Type N streams and buffering greater lengths of these streams than are currently proposed under Alternative 2. Although the design of this alternative (and the WDFW recommendations) would result in substantially better protection for both individual amphibians and amphibian populations compared to Alternative 1, the proposed buffers would not provide the optimum amount of protection.

ALTERNATIVE 3

Alternative 3 proposes similar riparian buffers on all streams on both the eastside and westside. The minimum buffer width is based on stream gradient. Streams with 0 to 20 percent gradient receive a 200-foot minimum width, 20 to 30 percent receive 100 feet, and greater than 30 percent receive 70 feet. Thinning would be allowed within these buffers, but only for the purpose of improving riparian function and after the landowner went through the appropriate SEPA procedures. Additional buffers are provided for BHZs and CDZs. CDZs are the areas within 30 feet of the lateral extent of an expected channelized landslide.

According to EBAI analyses, Alternative 3 would provide over 90 percent of the recommended protection for LWD recruitment and sediment filtration on all streams (see Section 3.5 and Appendix C). This result is logical since the proposed buffers on streams

Alternative 3 would result in low risk of effects on amphibian microhabitat variables, especially along lower gradient streams, although proposed buffer widths would still be below optimum for some variables. Along high gradient streams microhabitat variables would be well below optimum, but all would have some protection.

less than 20 percent gradient exceed the 170-foot buffer width requirement for sediment delivery and all Type N streams are consistently protected to some degree. Alternative 3 would protect approximately five times more acreage in affected lands with buffers compared with Alternative 2. Alternative 3 would also provide wide enough buffers on low-gradient streams to create some terrestrial habitat with microclimatic conditions suitable for amphibians, unlike either Alternative 1 or Alternative 2. For example, a 200-foot buffer would be wide enough to provide temperature and moisture conditions approximately 30 feet beyond the banks of the streams that would be suitable for the target amphibian species. This aspect of Alternative 3 is particularly important for the more terrestrial amphibians, such as the tailed frog and Van Dyke's salamander. Furthermore, Alternative 3 would provide additional buffers for beaver habitat. Since this buffer can apply on almost any small basin, low-gradient stream in the state, many streams could potentially have additional buffers added to them due to this provision of Alternative 3.

Based on the expanded primary buffers and additional buffers, Alternative 3 would be expected to provide the most positive benefits to amphibians through protection of sediment delivery, downed wood, and microclimate. However, it would be expected that some variables, such as air temperature and humidity, would still not be completely protected under the rules proposed for Alternative 3.

Unique Habitats and Target Amphibians

Scientists have identified several unique habitat features in the landscape that are of particular importance to the successful maintenance of healthy amphibian populations. These include stream junctions, Type N streams (under Alternatives 2 and 3), talus, and other refugia. This section analyzes the potential protection provided for these features by the proposed alternatives. Some of these features (e.g., stream junctions, Type N streams) are often associated with wetlands. Measures designed to protect wetland habitats can thus provide indirect protection to unique habitats that support the target amphibians. Therefore, this section also analyzes the wetland protection measures of the proposed alternatives.

ALTERNATIVE 1

Headwater streams, seeps, springs, and talus receive little or no direct protection under current FPRs. Protection of these unique habitats is largely indirect, occurring only to the extent that these habitats are associated with wetlands.

Current FPRs delineate Type A and B wetlands. Type A wetlands are non-forested wetlands with open water. Type B wetlands are non-forested wetlands lacking open water. The third category is forested wetlands. Current FPRs do not provide protection for wetlands smaller than 0.25 acre. The average buffer currently provided for any wetland is 100 feet. This buffer is provided only on Type A wetlands larger than 5 acres in size. Smaller Type A wetlands and Type B wetlands larger than 5 acres receive a 50-foot average buffer. Type B wetlands between 0.5 and 5 acres have an average buffer of 25 feet. Type B wetlands between 0.25 and 0.5 acres receive no buffer.

Alternative 1 would provide high risk of impacts to refugia and unique habitats for target amphibians.

These buffers are much smaller than those recommended in the literature. Semlitsch (1997) recommended buffers of over 500 feet around wetlands based on studies of pond-breeding salamanders in numerous studies from the Midwest and East. This large buffer was meant to encompass the terrestrial movements of 95 percent of the populations studied. Some of the more terrestrial of the target amphibian species, such as the tailed frog, Dunn's salamander, and Van Dyke's salamander, can spend considerable amounts of time in upland areas adjacent to riparian areas, usually within 150 – 300 feet from the stream (Gomez and Anthony, 1996). Thus, current RMZs do not protect all habitat used by these amphibians in their daily movements.

ALTERNATIVE 2

Alternative 2 would provide low to moderate risk of impacts to refugia and unique habitats for target amphibians.

Measures proposed under Alternative 2 would provide more protection to unique habitats than Alternative 1. The increased RMZs along Type S and F streams would increase the amount of protection for streamside unique habitats. Furthermore, and perhaps more importantly for amphibians, Alternative 2 would provide a variety of protective measures for Type N streams. Under existing FPRs, most such streams are classified as Type 4 or 5 and receive little or no protection. The torrent salamanders in particular, would benefit from protection of rock and cobble in the splash zone of Type N streams. These protective measures are described above for Alternative 2 under the "Microhabitat Variables and Target Amphibians" subsection. The lack of protection for isolated refugia such as talus would still allow some negative impacts to the more terrestrial amphibians (e.g., Dunn's and Van Dyke's salamanders, and tailed frogs) from future timber harvest.

Wetland buffers under Alternative 2 would not be significantly different from Alternative 1. However, increased RMZs would protect additional acres of wetlands in the affected lands (see Tables 3.5-3 and 3.5-4).

ALTERNATIVE 3

Alternative 3 provides the highest potential benefits for amphibians based on its proposed protection for refugia. It provides the widest potential buffers on riparian areas, ranging from 70-foot buffers on steep gradient (>30%) streams to 200-foot buffers on low gradient (<20%) streams. It also proposes the largest buffers on wetlands, including 200-foot buffers on Type A wetlands greater than 5 acres, 100-foot buffers on Type B wetlands, and snag and canopy retention standards on non-forested wetlands. These buffers are proposed as managed buffers, which means that they are intended to allow thinning where it is beneficial to the proper functioning of the riparian or wetland area (see Chapter 2).

Alternative 3 would provide low risk of impacts to refugia and unique habitats for target amphibians.

These proposed buffers would provide protection to most of the important refugia used by torrent salamanders in the landscape, such as the splash zone of Type N streams. It would also provide enough buffer on isolated wetlands (200 feet for Type A) to protect much of daily movements of salamanders and tailed frogs living in that environment. Despite these improvements, Alternative 3 would still not provide buffers wide enough to maintain all of the habitat requirements of amphibians using the refugia (Dodd and Cade, 1998; Semlitsch, 1998).

Other Riparian Species

The third criterion is the potential protection from the proposed alternatives for other riparian- associated wildlife species.

ALTERNATIVE 1

Current FPRs provide a variety of protections to wildlife species, particularly for species that are state or federally listed as threatened and endangered. These critical habitat prescriptions are listed in Section WAC 222-16-080 of the existing FPRs. Table 3.8-1 lists wildlife species in Washington that have some special status (e.g., state or federal listed, species of concern, or high profile species) and are considered strongly associated with riparian areas for breeding and/or foraging. This table is not meant to be inclusive of all wildlife species in Washington that are associated with riparian areas. As discussed earlier, over 85 percent of Washington's native fauna use riparian areas for some portion of their life cycles. Instead, Table 3.8-1 is limited to species with some special status. Nonetheless, this table provides a general indication of the wide variety of species that could be affected by the proposed alternatives.

> Alternative 1 would provide high risk of impacts on other riparian species.

Alternative 1 would do nothing to benefit these other riparian-associated species beyond existing FPRs. Some of the species, such as the Oregon spotted frog, western pond turtle, and Columbian white-tailed deer have extremely limited distributions. While this makes them very vulnerable to extinction, it is unlikely that private forest practices are going to impact these species significantly because site-specific management plans are in place for most of the extant populations (McAllister and Leonard, 1997; Larsen, 1997). Some of the more widely distributed species, including Cascades frog and the red-legged frog, use aquatic and riparian habitats for breeding, but are usually found in more upland habitats for the rest of their life cycle. Current riparian buffers are most likely inadequate for some of these other amphibian and reptile species. Western pond turtles may require buffers well over 1,000 feet in width to accommodate their upland breeding habitat (Holland, 1994). The northern leopard frog is distributed mainly in the shrub-steppe vegetation zone of southeastern Washington, so it would not be significantly affected by existing or proposed FPRs (McAllister et al., 1999). Finally, many of these species are likely to occur in small, temporary wetlands, many of which are not currently protected if they are less than 0.5-acre in size. Cascades frogs can be very abundant in small, isolated high elevation wetlands (Larsen, 1997). As recommended by Dodd and Cade (1998), buffers of over 600 feet may be necessary to adequately protect all the habitat required for the migratory patterns of amphibians in these small wetlands.

As for many of the bird species listed in Table 3.8-1, current RMZ prescriptions do not attempt to protect all of the habitat requirements of these species. The bald eagle receives specific protections for its critical habitat requirements due to its federal threatened status. These special provisions protect large buffers around known nest sites. As for the other avian species, Alternative 1 would do little to minimize negative impacts to these species from human activities. For instance, 100-foot buffers along streams occupied by nesting harlequin ducks are recommended because that is the necessary distance to recruit large woody debris for loafing (Larsen, 1997). Even larger buffers (164 feet) have been recommended to protect suitable nesting habitat (Cassirer and Groves, 1990). Buffers up to 600 feet wide have been recommended for cavity-nesting ducks and pileated woodpeckers (Larsen, 1997).

Similar to the birds mentioned above, the mammals listed on Table 3.8-1 require very large buffers. Some studies have recommended riparian buffers of 100m (328 feet) to protect the area of optimum foraging and cover habitat for mink and beaver (Melquist et al., 1981; Allen, 1983; Knutson and Naef, 1997).

ALTERNATIVE 2

Alternative 2 would provide low to moderate risk of impacts on other riparian species.

Compared to existing conditions, Alternative 2 would be expected to improve habitat for other riparian-associated species in Washington in four mains ways : 1) Alternative 2 would substantially increase the acreage of riparian habitat protected by no-harvest buffers (see Figures 3.4-7 and 3.4-8); 2) it would increase the amount of riparian habitat protected by selective harvest buffers and equipment limitation zones (see Figures 3.4-7 and 3.4-8); 3) it would provide protection for riparian habitat along headwater (Type N) streams, which generally receive no buffers under Alternative 1; and 4) it would provide improved wetland protection due to better mapping techniques and protection of seeps and springs connected to Type N streams (see Section 3.5, Wetlands). These measures would have benefits for riparian-associated species, but the extent of the benefits is unknown.

ALTERNATIVE 3

Alternative 3 would provide low risk of impacts on other riparian species.

Compared to existing conditions, Alternative 3 would have the most positive benefits for other riparian-associated species in Washington. Similar to Alternative 2, they would benefit in four main ways : (1) Alternative 3 would substantially increase the acreage of riparian habitat protected by no-harvest buffers (see Figures 3.4-7 and 3.4-8); 2) it would provide protection for riparian habitat along streams with gradients greater than 30 percent, which generally received no buffers under Alternative 1; and 3) it would provide improved wetland protection due to improved mapping techniques and protection of seeps and springs connected to Type N streams (see Section 3.4, Wetlands). These proposed measures would have benefits for riparian-associated species, but the extent of the benefits is unknown. Nevertheless, Alternative 3 would provide the most protection and potential habitat improvement for other riparian-associated species of any of the alternatives.

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